



November 22, 1999

Ms. Magalie Roman Salas, Secretary  
Federal Communications Commission  
The Portals, TW-A325  
445 12<sup>th</sup> Street, S.W.  
Washington, D.C. 20554

Re: Ex Parte Notification – WT Docket No. 99-168

Dear Ms. Salas:

The attached letter is being filed on behalf of Motorola, Inc. (Motorola) and addresses technical issues raised in this proceeding by FreeSpace Communications. As such, this letter should be associated with the record of WT Docket No. 99-168.

Please contact Leigh Chinitz at (202) 371-6940 regarding any questions concerning this matter.

Respectfully Submitted,

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Leigh M. Chinitz  
Motorola, Inc.

Attachment

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## **I. Introduction**

On November 15, 1999, FreeSpace Communications (“FreeSpace”) submitted its response to Motorola’s technical analysis of the ability of FreeSpace to provide interference protection to the 700 MHz allocation for public safety services. In their filing, FreeSpace asserted that Motorola “mischaracterizes the record or engages in unfounded speculation in an effort to conjure up a parade of horrors and create the false impression that the FreeSpace proposal will not protect public safety operations from interference.” In an effort to clarify the record, we take this opportunity to respond to several issues, both of a technical and policy nature, which are raised in this most recent FreeSpace filing.

## **II. An Allocation to PMRS is Consistent with Congressional Intent**

In the policy realm, of primary importance in the FreeSpace letter is the implication that Motorola’s proposal is inconsistent with the statutory language of section 337(a)(2) of the Communications Act, as amended, which directs the Commission to allocate the spectrum between 746 and 806 MHz. Free Space states that the Commission can not allocate spectrum in this band to the Private Mobile Radio Service because “[a]fter all, it is important to keep in mind that section 337(a)(2) of the Communications Act designates that these bands be allocated for such ‘commercial use.’ ” It is Motorola’s position that an allocation of spectrum to the Private Mobile Radio Service is in accordance with this wording in the Act.<sup>1</sup> As we have delineated in more detail in our previous filings, Section 337(a)(2) directs the Commission to allocate spectrum in two portions: a 24 MHz portion for “public safety services”<sup>2</sup> and another portion of 36 MHz “for commercial use to be assigned by competitive bidding pursuant to Section 309(j).”<sup>3</sup> When examined in this context, the term “commercial use” is meant to distinguish this spectrum from public safety services. The meaning of the term “commercial use” is not limited, as FreeSpace contends, to services that are subscription type communications services. Had Congress meant to preclude the use of the spectrum by private users, it would have done so explicitly, and could have done so by using either of two terms defined in the Act, “Commercial Mobile Radio Service”<sup>4</sup> or “Telecommunications Carriers.”<sup>5</sup> Instead of limiting the use of the

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<sup>1</sup> See Letter from Robert L. Pettit, Wiley, Rein & Fielding, on behalf of Motorola, Inc., to Ms. Magalie Roman Salas, Secretary, Federal Communications Commission, WT Docket No. 99-168, dated November 3, 1999.

<sup>2</sup> 47 U.S.C. §337(a)(1)

<sup>3</sup> 47 U.S.C. §337(a)(2)

<sup>4</sup> 47 U.S.C. §§ 153(44),(46).

spectrum by specifying these defined terms in the legislation, Congress used broader terminology, choosing the term “commercial”, which can encompass the use of the spectrum by private entities engaged in commercial endeavors.

Moreover, not only does the Commission have the authority to allocate spectrum to PMRS, it is in the public interest for the Commission to do so. The allocation of substantially similar services in adjacent spectrum will not only protect the public safety operations, as discussed in more detail below, it will result in increased economies of scale for manufacture of public safety equipment that will lead to lower cost, more advanced equipment becoming available to the public safety community. In addition, the PMRS community has well documented its need for additional spectrum to support its growing operations.<sup>6</sup>

### **III. Technical Issues**

The vast portion of the November 15 letter from FreeSpace deals with technical issues and interference management concerns. Motorola offers the following responses to a variety of issues raised by FreeSpace.

#### **A. Frequency coordination has been used successfully to avoid interference for decades**

The fundamental misunderstanding on the part of FreeSpace is in the area of how frequency coordination operates and why Motorola believes that such coordination is essential. As

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<sup>5</sup> 47 U.S.C. §332(d)(1).

<sup>6</sup> The demand for new PMRS spectrum allocations is best demonstrated in the *LMCC Petition*. See *In the Matter of an Allocation of Spectrum for the Private Mobile Radio Services*, RM 9267, submitted by the Land Mobile Communications Council on April 22, 1998. Relying on frequency use data prepared by the NTIA, the *LMCC Petition* showed that existing PMRS allocations suffer from “heavy congestion” and are incapable of meeting projected demand. In addition, many private wireless interests have participated in this proceeding and demonstrated the demand for new PMRS allocations. See, e.g., Comments of the United Telecom Council (“UTC”), WT Docket No. 99-168, at 2 (filed July 20, 1999); Comments of MRFAC, WT Docket NO. 99-168, at 4 (filed July 20, 1999); Comments of the Personal Communications Industry Ass’n (“PCIA”), WT Docket No. 99-168, at 3 (filed July 19, 1999), Letter to Thomas Sugrue from A. J. Fasse, Ford Communications, Inc., WT Docket No. 99-168 (filed October 29, 1999); Letter to William E. Kennard from Edwin F. Kemp, Union Pacific Railroad Company, WT Docket No. 99-168 (filed October 28, 1999).

Motorola has stated many times in this proceeding, our opinions on this subject are based on real world experiences with interfering systems in, for example, the 800 MHz band. The most telling statement made in the November 15<sup>th</sup> letter comes after FreeSpace presents its analysis of interference based on some assumptions about emission masks. “Given the result above,” they write, “one can expect near-far situations to occur between PMRS and public safety units, even with frequency coordination.” This statement is refuted by the decades-long history of frequency coordination and cooperative frequency use between these two services. Private wireless and public safety users have shared allocations in the 150 MHz, 450 MHz and 800 MHz bands.<sup>7</sup> However, incidents of interference between public safety and private wireless users have been remarkably limited over the years in large part due to the inter-service coordination processes developed by industry.

Several other comments made by FreeSpace indicate that they are not fully aware of what the frequency coordination process entails. “For example, it is unclear how Motorola’s frequency coordination process will accommodate *future* as well as current public safety systems,” they write. As the Commission well knows, whether the systems are future systems or are current systems is irrelevant, since frequency coordination is an ongoing process. When a new channel is desired, one of the designated frequency coordinators (and all frequency coordinators share their assignment information) will examine the existing use in the area and determine the most appropriate frequency to assign. This will happen when any of the channels, in either the Public Safety or the proposed PMRS band, are assigned at any time, anywhere. Similarly, in response to our concern that FreeSpace transmitters located throughout a building might create a potentially damaging interference scenario with Public Safety units required to deploy in the building, FreeSpace comments that “Motorola does not explain why PMRS systems operating under its proposal are not just as likely to create the same scenario.” Again, this demonstrates a fundamental lack of understanding as to how the frequency coordination process works. This interference scenario does not occur between Public Safety and PMRS systems because a coordinator would not assign a frequency, even one used for an in-building purpose, that would conflict with locally allocated Public Safety frequencies. They would not do this because they understand the importance of the various interference scenarios.

**B. Other safeguards proposed by FreeSpace are inadequate, or the information provided remains inadequate**

Aside from its misunderstanding on the issue of frequency coordination, FreeSpace commented in its letter that, though it had defined certain safeguards to protect Public Safety, Motorola “glosses over or ignores each of these safeguards, even though they were clearly set forth in FreeSpace’s November 8 *ex parte* submission.” Motorola did not intend to ignore any safeguards that we felt could actually provide protection to the Public Safety operations. However, many of

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<sup>7</sup> See e.g., 47 C.F.R. §90.617 (assigning adjacent 800 MHz channels to the Public Safety Category, Industrial/Land Transportation Category and Business Category services).

the protections that FreeSpace has mentioned actually appear to make the situation worse. The FreeSpace comments do appear to indicate a lack of understanding of land mobile system design.

**1. Base station to base station interference is not the critical issue; base station separation does not solve the base station to mobile station interference problem**

For example, “FreeSpace has stated that it would support a requirement that users of the low power guard bands immediately adjacent to public safety bands locate their base stations designated distances from public safety sites in order to achieve additional protection against interference.” While at first blush it may appear that separating the base sites is a way of achieving additional protection, in fact it makes the important interference situations worse. First of all, the only interference that such an approach would mitigate is the interference from one base station into another.<sup>8</sup> With mobile systems, the more problematic situation is due to interfering base stations disrupting the communications of victim mobile receivers. The situation is the following. A victim receiver is attempting to receive its desired signal which is weak, possibly because of physical separation from the base station or shielding because the victim unit is in a building, behind a mountain, etc. As the victim mobile unit approaches an interfering base station, the unwanted emissions from that base station make it impossible for that unit to receive the weak desired signal. When the victim mobile unit is being used by Public Safety personnel, the interference could have severe consequences. The standard way of dealing with this situation is in fact exactly the opposite of what FreeSpace has proposed. To mitigate this situation a typical solution is to have base stations of different systems co-located so that effects due to distance or shielding apply equally to the intended and the interfering signals, thus maintaining a relatively constant signal-to-noise ratio.

If FreeSpace were to change its opinion on this subject and recommend co-siting of FreeSpace and Public Safety transmitters, there would still be a serious problem with this interference scenario. That problem is precisely the one that Motorola has been trying to avoid throughout this process and which was the primary driver behind Motorola’s proposed band plan; the deployment of systems with fundamentally different deployment scenarios in the same spectrum in the same geographic area will interfere with each other. Given the intended power of their transmitters, the FreeSpace system will clearly have many more sites than a high-site, wide area

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<sup>8</sup> Since the 764-776 MHz spectrum is being used for Public Safety base transmit, while the 794-806 MHz spectrum is being used for Public Safety base receive, it is very unlikely that interference from FreeSpace base stations into Public Safety base stations would occur anyway. The only way this would be possible would be if FreeSpace were to use the spectrum immediately below 794 MHz for base station transmit rather than mobile station transmit. While FreeSpace has not clearly stated its intention to follow the base station and mobile station transmit rules of the Public Safety plan, it should be clear that if they do not, many more interference scenarios would be created, all of which would have to be addressed and resolved.

Public Safety system. They might be able to co-locate base stations on the Public Safety towers, but at all the locations between Public Safety towers where FreeSpace would be forced to place base stations, the interference scenario described above would occur.

**2. Automatic interference avoidance can only work for base station interference; GPS related techniques have many issues which need to be addressed**

In a related topic “FreeSpace has noted that internetworked systems, such as the FreeSpace system, could be designed to automatically avoid situations that may lead to interference. For example, by making a database of public safety locations available over the network, those units that find themselves positioned too close to a public safety site could automatically switch channels or shut down to avoid interference.” This statement also displays a misunderstanding of the details of mobile system deployment. In this case, the focus appears to be interference from FreeSpace units into Public Safety base stations. As stated above, the most destructive interference scenario based on Motorola’s extensive field experience, is that which is caused by an interfering base site blocking a victim mobile receiver, not the other way around. This solution, too, does not address the scenario above. In addition, while the idea of a database of Public Safety locations which would cause GPS enabled FreeSpace units to shut down in the event of some proximity threshold being reached is a very interesting idea inasmuch as it is necessary to prevent interference into base stations, there is so much in this idea which has yet to be defined that it seems to us unwise for the FCC to consider basing the protection of Public Safety systems on it. For example, at what distance would the trigger be set? With what precision would the FreeSpace units be required to know their own position? If a consumer can install the FreeSpace units, how would you enforce the requirement that the position be entered in a database? If the unit were required to have GPS in order to report its own position regardless of who installed it, how would units located inside buildings report their positions since GPS does not work that well inside buildings, or even in cities in general?

**3. FreeSpace interference to Public Safety at the same level as that caused by large carriers would not be an improvement on the Motorola plan**

In Motorola’s previous letter regarding the FreeSpace proposal, we speculated that the FreeSpace system would result in four times the interference as would be caused by the consumer-oriented carriers in the CMRS portion of Motorola’s plan. FreeSpace takes issue with that analysis in several respects. We find several portions of their November 15<sup>th</sup> response on this subject to be quite telling. The Motorola position on the subject of interference has been, and remains, very clear. The maximum amount of interference that the Public Safety users can tolerate is –132 dBm in the first 6.25 kHz. The Motorola plan accomplishes this for the CMRS carriers via –57 dBm emissions and 75 dB of site isolation. (The 75 dB site isolation value is a measured number based on deployed 800 MHz systems.) We stated several times in our previous letter that not enough information had been placed on the record to guarantee that the FreeSpace proposal was capable of protecting Public Safety. In their response FreeSpace writes, “Let us assume, as

proposed by Motorola, that units operating in the guard bands adjacent to public safety bands must comply with Motorola's proposed out-of-band emissions limit of -57dBm in a 6.25kHz bandwidth." This is the first time we have seen any indication of out-of-band emission specifications proposed by FreeSpace. Since we now have this information, albeit in a form that does not actually state what emission levels FreeSpace proposes for its own equipment, let us assume, for the sake of convenience, that we agree with the FreeSpace analysis on the subject of interference caused by FreeSpace. They conclude, "It follows that, while there may be more FreeSpace sites, the interference area per site is less than one fourth that of the 100 watt CDMA CMRS system Motorola uses for its example." If we assume as we did previously that a FreeSpace system would have four times the number of sites, and if we agree that the FreeSpace interference area per site is about one-fourth that of the CMRS systems, we find that the interference caused by the FreeSpace system is the same as that caused by the CMRS systems.

What this means is that, while in the Motorola plan the Public Safety entities get no interference from PMRS (because of frequency coordination) and a certain level of interference from CMRS, in the FreeSpace plan the Public Safety entities get a certain level of interference from CMRS (they have not gone away) and an equivalent level of interference caused by FreeSpace. We cannot emphasize strongly enough the importance of this result. From the Public Safety point of view, the Motorola plan means limited interference from CMRS and no interference with PMRS due to coordination. The FreeSpace plan, on the other hand, means limited interference from CMRS and the same amount of interference from FreeSpace. Using their own result, the FreeSpace plan has to be at least twice as bad for Public Safety from an interference point of view.

#### **4. TDMA does not guarantee that interfering frequencies can be avoided**

On some other subjects FreeSpace complains that Motorola ignored their information, though they were forced to provide new information in their letter to make their point. For example, they claim that Motorola's concerns about spread spectrum use were unfounded since they clearly stated that they would use TDMA to limit access to the spectrum. However, just stating that TDMA is to be used is not nearly enough information to address the fundamental question of, as FreeSpace puts it, whether "the systems operating in the guard bands use more than one channel." If TDMA were used with spreading within each time slot (a technology which exists) to provide more granularity, clearly there would not be more than one channel from an interference point of view. A single channel would be a spreading code within a time slot. It was not until the November 15<sup>th</sup> letter that it was stated that "the FreeSpace system will not use only a single frequency channel." We note, however, that FreeSpace has still not disclosed any information about the bandwidths and emission characteristics of their technology so that a true interference analysis can be performed.

**5. Indoor interference scenarios are potentially hazardous, and they can be alleviated by a frequency coordination approach**

On the subject of the potential interference hazard posed by deployment of multiple indoor FreeSpace base stations, FreeSpace argues that because their base stations will have power control this is not a problem. “Furthermore,” they state, “interference in this situation would require a coincidence of circumstances that make it improbable. Namely, the victimized public safety mobile unit would have to be in the same room as, and in fact very close to, the offending transmitter, in an indoor environment where power control is ineffective, at a time when the unit is on, and at a location near the edge of the coverage region of the public safety system. The coincidence of all of these events would be unusual, making Motorola's ‘worst-case scenario’ more hypothetical than real.” On the contrary, Motorola does not believe that this scenario is so unlikely that it can be disregarded. As stated in the November 15<sup>th</sup> letter, FreeSpace “seeks to provide a *nationwide* wireless broadband network that reaches all communities, bringing competition to areas that are currently served and new service to those that are not.” It makes sense, then, to assume that in a successful deployment there would be many FreeSpace transmitters located in buildings and in scattered throughout densely populated areas. That Public Safety officers, in the course of their duties to respond to life-threatening or property-threatening situations might converge inside one of these buildings or in an area in which these stations have been deployed does not seem to us in any way farfetched. It is up to the Commission to weight the costs and benefits in cases such as this, but to Motorola the risks to Public Safety are not outweighed by any benefits from the FreeSpace plan which have been discussed so far.

**IV. Conclusion**

In the spirit of continuing public dialog we expect that FreeSpace will respond to these comments with their own analysis. In anticipation of that Motorola would like to offer one observation. The November 15<sup>th</sup> letter from FreeSpace attempted to refute Motorola's experience in deploying land mobile communications systems with a theoretical analysis of the likely interference events. Their conclusion was that “Given the result above, one can expect near-far situations to occur between PMRS and public safety units, even with frequency coordination.” Since their analysis resulted in a conclusion refuted by decades of experience, it seems only reasonable to treat other results of their analysis with some caution.